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LLNL Standard Criticality Controls - History, Features and Advantages

J. Pearson, D. Biswas, J. Scorby

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John S. Pearson, Debdas Biswas and John Scorby

Lawrence Livermore National Laboratory
P.O. Box 808, L-360, 7000 East Avenue, Livermore, California 94551
pearson3@llnl.gov, biswas2@llnl.gov, and scorby1@llnl.gov

INTRODUCTION

Since 1998, Lawrence Livermore National Laboratory (LLNL) has utilized a system of Standard Criticality Control Conditions (SCCCs) in the Plutonium Facility operations. This paper discusses the history, features, advantages and disadvantages of this system.

HISTORY AND FEATURES

The concept of SCCCs was developed at LLNL in 1998 to provide consistent controls across multiple work stations. At the time, the Plutonium Facility was in the process of resuming operations ("Resumption") after a series of criticality safety infraction incidents. Management felt that increased consistency of the criticality safety controls would help reduce the number and severity of infractions. Hence, a system of SCCCs was developed and implemented.

Each SCCC provides consistent controls (i.e., the wording of each SCCC is the same wherever it is used). Each SCCC typically addresses mass, material form, moderation, reflection and shape controls. In some cases other parameters are controlled. Normally as the mass limit increases, so are the restrictions on moderators and reflectors. For example, SCCC A allows a small quantity of mass (65g of Pu or 110g or ^{235}U) without any restriction on moderators or reflector, SCCC L allows up to 4.5 kg of Pu with a limited liquid volume of 1 liter and SCCC Ox allows up to 15 kg of Pu or ^{235}U in the form of oxide without any liquid in addition to restrictions on how the fissile material is distributed within the glovebox. A color-coded posting (see Fig. 1) was developed for each SCCC to further aid the fissile material handlers (FMHs). Four of the SCCCs (e.g., SCCC A, B, W and Z) that are described in the Facility Safety Plan are widely used throughout the facility. Generally SCCCs are implemented for specific operations through Operational Safety plans (OSPs). OSPs describe the hazards and controls for specific operations performed in the Plutonium Facility and are required for operations involving accountable quantities of Pu or ^{235}U.

The original concept envisioned a relatively small set of SCCCs. During Resumption, criticality safety staff worked closely with Program and Facility staff to develop appropriate SCCCs as program areas resumed operation. It soon became apparent that different operational areas (e.g., casting, recovery, material processing, machining, waste handling, and so forth) had specific needs, so appropriate SCCCs were developed which were tailored to these areas. This provided consistent controls within those areas, but the number of SCCCs increased from the original concept.

As the SCCC system was implemented, it also became clear that some workstation specific controls were needed which were not generic across multiple workstations. These often involved controls on specific equipment, for example. Hence, in addition to the SCCCs, some workstation-specific controls were also developed.

Since Resumption, criticality safety staff continued to work closely with Program and Facility staff to provide appropriate SCCCs and workstation specific controls for new and changing operations in the dynamic research and development environment present in the Plutonium Facility. Sometimes, new SCCCs were developed to meet new needs, for which no existing SCCC applied well. At other times, SCCCs which were no longer needed were removed from operations.

The number of SCCCs in use has varied since Resumption as new SCCCs have been introduced to meet Program requests and other SCCCs were deleted. Since Resumption, a perception has persisted among some staff that there are too many SCCCs, that the original simplicity of just a few controls across the facility was not realized. However, most FMHs, when asked, appear to be satisfied with the current SCCCs in their own areas. Periodically, criticality safety staff explore with the Program and Facility staff about potential reductions in the number of SCCCs, and these efforts have resulted in some changes. Typically, when SCCC changes are needed, criticality safety staff work with customers on a case-by-case basis.

CURRENT USE OF SCCCs

The current number of SCCCs (24) is larger than the number at the end of Resumption (17) and much larger than originally envisioned (approximately four to six). A few SCCCs are widely used throughout the Plutonium Facility. However most SCCCs are used for a limited group of related operations.

ADVANTAGES AND DISADVANTAGES

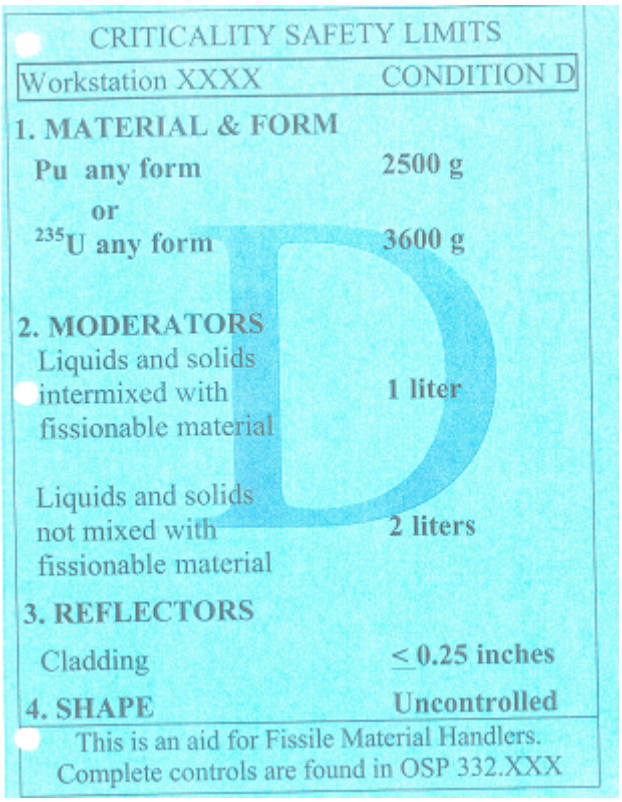
The original concept of the SCCCs was to provide simplicity and consistency throughout the facility. The controls of each SCCC are the same in each operation where it is used. Further, the SCCC postings are uniquely color-coded, which makes it easy for FMHs to recognize which SCCC is authorized (posted) for each workstation. As the system was implemented, SCCCs were developed for groups of operations and customers. Hence, these SCCCs fit those operations very well. These are advantages of the system. On the other hand, this method of implementation led to a larger total number of SCCCs within the facility, which led to the persistent perception that there are too many SCCCs and hence the system is not as simple as originally conceived. Also during implementation, it was recognized that some additional criticality safety controls are needed to address very specific requirements of individual workstations. This led to the need for "workstation specific controls" which further reduces the intended simplicity.

However, looking at the broad picture, the low number and severity levels of criticality safety infractions since Resumption tends to confirm the over-all success of the system.

CONCLUSION

The current system of criticality safety controls in the Plutonium Facility, utilizing SCCCs augmented by workstation-specific controls as needed, has generally worked quite well. The LLNL criticality safety staff continue to work with the Program and Facility staff in the Plutonium Facility to identify ways to simplify the controls while ensuring safety and meeting customer needs.

Fig. 1. SCCC D Posting



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